July 2011

NORTEK AS

SERVICE MANUAL

CONTENTS

INTRODUCTION

The purpose of this manual is to aid in troubleshooting and re-configuration tasks, and is meant to be a supplement to the existing Operations Manuals. Inevitably, these manuals will overlap on certain points.

This manual covers the Aquadopp, Aquadopp Profiler, AWAC, Continental and Vector instruments, which bear many similarities to each other.

INFORMATION SOURCES FOR NORTEK PRODUCTS

Manuals

Every instrument comes with a manual. There is valuable information inside!

Nortek Forum (http://www.nortek.no/forum)

There are over 500 conversations logged on this site. It just might be that someone else has had a similar question or problem as you. Many of these are answered on the forum. If not, and the answer could be of value for others – start a new conversation and we will answer.

Internet (http://www.nortek.no/)

Our newly redesigned webpage is now full of news, upcoming event and product descriptions. You can download instrument manuals and upgrade both firmware and software. All information needed for returning for repair or integrating your instrument to others is also there. Loads of technical notes and other Bibliography is ready to be downloaded.

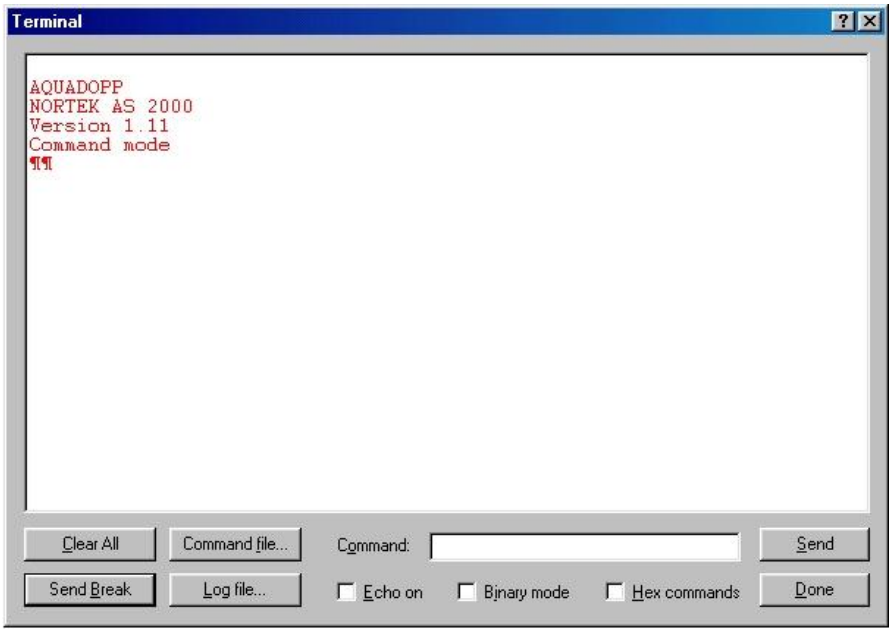
Please use it, and if you don't like it or something is missing – let us know.

1. FUNCTION TESTING

1.1 INITIAL TEST SETUP

Power. Before you start testing the instrument, be sure that it has a source of power. Power will normally come from the internal battery or from the AC/DC converter that is delivered with most systems. Refer to Operations Manual for instructions on opening the end cap to plug in the battery. You may also supply power from your own external supply. If you use your own supply, be sure the voltage does not exceed 16 V DC (18V DC for Continental), and that it can supply 2 to 3 A

Connect cables. If your cable is new, protect the cable connector by applying a thin layer of silicone lubricating spray to the pins before you plug it into the Instrument. Plug the appropriate ends into the instrument and to the computer. Make sure the computer connector does not easily fall out.



Start the appropriate software.

Verify communication by clicking the *connect* button. The software will automatically find the instrument and read its current setup parameters. Alternatively, select *Communication -> Terminal Emulator*, and press the *Send Break* button. The instrument should respond with a message similar to the one in the screenshot.

1.2 SENSOR CHECKS

Prepare a test deployment which allows you to see data every second. Click *Deployment -> Planning*. For profiling instruments - set profiling interval = 1 sec. For current meters - measurement interval =1 sec. For Vector Choose *continuous sampling*, then click *OK*. Start the test deployment by clicking *On-line -> Start Data Collection* or click the *Start Data Collection* toolbar button.

The final test check list found in Appendix A is has been used at our factory for years and is a quick, but good test of the system.

1.2.1 TEMPERATURE

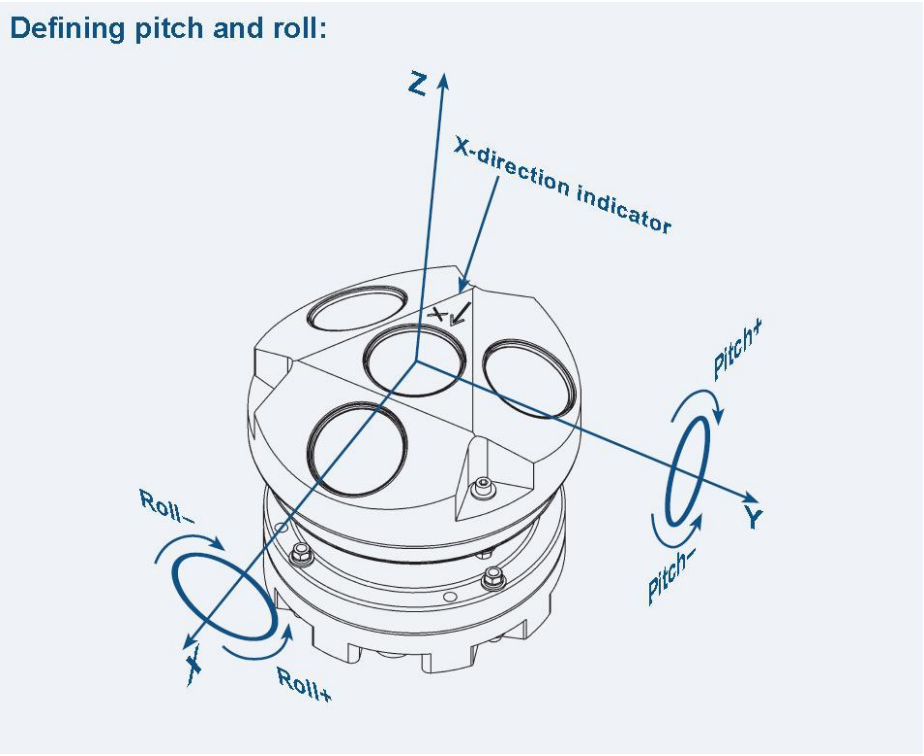
Temperature should be close to your room temperature, assuming the instrument has been in the room for a while, to allow for the long time constant. The temperature sensor is located inside the sensor head, and has a time constant of approximately 10 to 15 minutes.

There is an option in the software for adjusting the temperature. This option will be removed in later software. Only use this option if there is a large error in the readings and your timeframe doesn't allow to send it to repair before your deployment.

1.2.2 TILT

Hold the instrument and slowly tilt it in different directions, verifying that the pitch and roll readings are sensible. Be aware that the Vector needs to be oriented in the right up/down orientation when starting it – up/down orientation will not be updated while measuring.

Defining pitch and roll:



1.2.3 COMPASS

Hold the instrument away from any magnetic influence (like metal objects etc.), slowly rotate it in different directions, verifying that the heading readings are sensible. When testing a Vector, click *Stop Data Collection*, invert instrument, click *Start Data Collection* and repeat above procedure.

1.2.4 PRESSURE

Please have in mind that the pressure sensor is not a depth meter but a pressure sensor. Due to atmospheric pressure variations, the sensor signal may have an offset, please adjust this to a positive number before testing it (e.g. 0,2m) (*On-line->Set Pressure Offset)*. Place the instrument in a suitable container filled with water approximately 0.5 m deep and verify that the pressure reading is correct.

1.3 SIGNAL STRENGTH AND PINGING CHECKS

First check the noise level of the instrument. Pinging in air should produce a signal strength (Amplitude) of 45-55 counts for Vector, 50-60 counts for Continental 15-30 counts for rest. This signal level is called the noise floor. When the instrument pings in air, the velocity measurements will be nothing but noise. Put the instrument in a bucket of water and observe the signal strength and the velocity. The signal strength should rise noticeably (the actual level depends on the size, shape and material of the bucket), and the velocity data should appear less noisy.

To get everything right the first time, you may want to verify that your Nortek instrument actually emits pings before you deploy. As described in our manuals, this is done by means of a simple AM radio.

Actually, this is a very simple thing to do. A small portable AM radio is all you need. Adjust the radio to the frequency of your Nortek instrument, i.e. for a 1MHz Aquadopp adjust the radio to 1MHz, for a 600kHz system adjust it to 600kHz, and so on.

Start the Nortek instrument and hold the radio close to the transducers. What you now hear is the pings themselves (they sound like a busy woodpecker). Stop the test by clicking *On-line -> Stop Data Collection* or press the *Stop Data Collection* button.

1.4 BEAM AMPLITUDE AND VELOCITY CHECKS

1.4.1 GENERAL CHECKS FOR ALL INSTRUMENTS

The following checks should be carried out in a suitable stretch of unobstructed water. If there are insufficient scatterers in the water, some seeding material may be necessary. We recommend carrying out initial testing in a test tank, which is both convenient and provides a controlled environment. After the tank test, final testing can be carried outside in open water, such as a lake, river or sea. Nortek can provide further details on suitable test arrangements on request.

Amplitude

Start the test deployment by clicking *Online*, *Start Data Collection* or click the menu button *Start Data Collection*. Click the *Amplitude* or *Profile* tab to observe the amplitude of all beams on the graphic display.

Hold the instrument and immerse the transducers as deeply as Point each beam in turn slightly down from the horizontal (relative to the transducer) and away from any obstructions. Note the amplitude of each beam, displayed in counts. All the beams

should have similar amplitude, within 10 counts of each other. When testing an profiling instruments, the beams should be compared in the same cell, normally the first one.

To get a better understanding please use Range Check for Aquadopps (*On-Line -> Start Range check)* and Probe check for Vector and Vectrino (*On-Line -> Start Probe check))*

As an additional check, each beam can be blocked in turn, by either holding each transducer out of the water (while keeping the others immersed) or by covering it with a suitable acoustic attenuating material such as a dense plastic, or even a finger. The amplitude of the blocked beam will fall to around the noise level, while the others will remain unaffected.

Velocity

Change the beam coordinate system to XYZ Coordinates by clicking *XYZ* in the Advanced Deployment Planning menu. Start the test deployment by clicking *Online*, *Start Data Collection* or click the menu button *Start Data Collection*. Click the *Velocity* tab to observe the X, Y and Z velocities on the graphic display.

Move the instrument backwards and forwards at a constant velocity through the water, along the X axis. A positive and negative deflection of the X axis velocity should be observed on the the graphic display, while the Y and Z axis velocities should remain around 0 m/s. Repeat the procedure for the Y and Z axis. Ensure that the displayed velocities are reasonable.

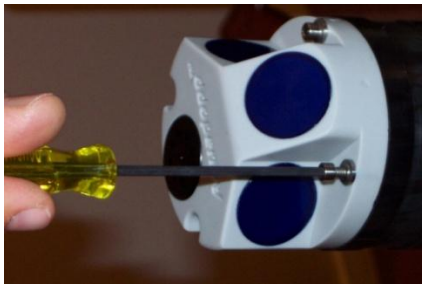
Beam order and x,y,z definitions is available in the instruments manual.

4. WORKING INSIDE AN INSTRUMENT

When opening the instrument, great care should be taken to keep the sealing surfaces clean and protected from mechanical damage.

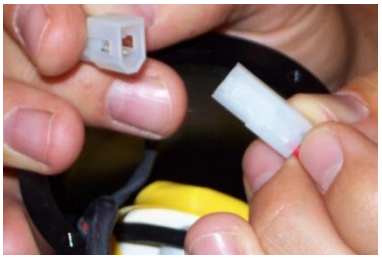
4.1 ACCESSING THE CIRCUIT BOARD

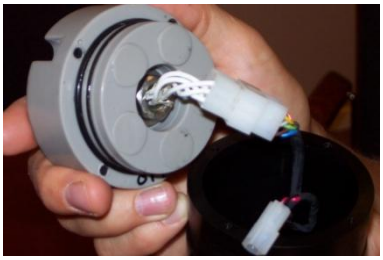
The following procedure describes how to access the Paradopp circuit board, the necessary tools can be found in the supplied toolkit. Great care should be taken when opening the instrument to avoid mechanical damage to mating surfaces (refer to Section 5).



Remove the four #6-32 x ¾" titanium screws and washers holding the end cap to the pressure case and remove the pressure case.

Disconnect the 2 pin and 9 pin connectors and pull the battery out of the pressure case.





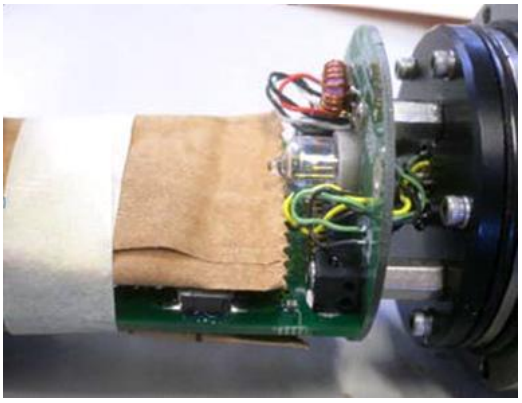
Remove the four #6-32 x ¾" titanium screws and washers holding the transducer head to the pressure case.

Slide out the head with the circuit board attached

4.2 CHANGING A TRANSDUCER HEAD

The procedure for changing a transducer head also includes updating the instrument's head configuration file. The only tools you need are 7/64" and 1/16" hex driver. The following procedure outlines how to change the transducer head.

1. Unscrew the three or four screws that secure the head to the housing. Gently pull the main board. If a you are working with a Vector, remove the two bags of desiccant taped around the board and gently disconnect the ground
strap on the reverse side of the board.

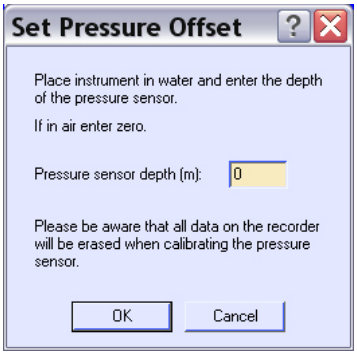


2. Unscrew the two screws fixing the board to the head board, and pull the head away from the board.

3. Attach new head/probe. Be careful not to squeeze the
cables. Reattach dessiccant.

4. Load new headfile into the instrument: Connect the instrument to a PC. In the instrument software, choose Configuration -> Sensor Head.
Browse, and select the new headfile, received either as an e-mail attachment, or on an enclosed CD.

5. Set pressure offset: in the instrument software, choose *On line-> Set Pressure* Offset
from the menu. type in desired offset, click OK



Simple function test.

It's a good idea to run a simple function test before deploying.

1. Start the instrument in continous sampling.

2. Check that the various sensors gives reasonable values:

Pressure- see that the pressure shows an offset according to the offset set earlier.

Check that the other sensors are giving reasonable values.

4.3 INSTALLING A MEMORY BOARD

Vector, aquadopp and aquadopp profiler before midlife

When ordering a memory upgrade from Nortek you will receive the following.

1. Nylon standoffs

2. Short nylon screws

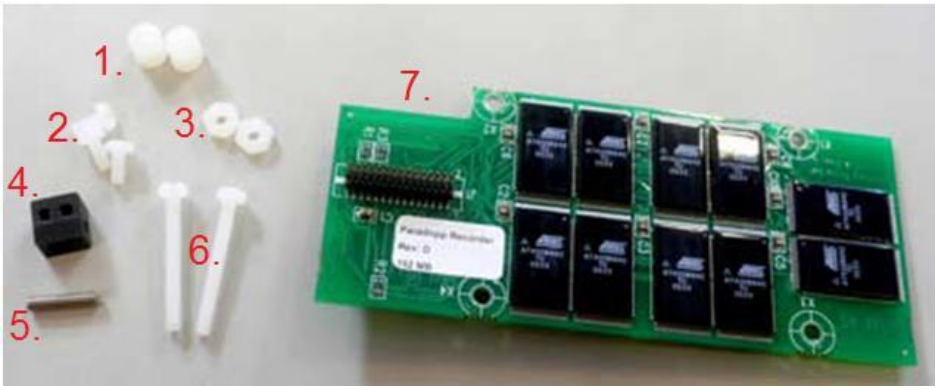
3. Nylon nuts

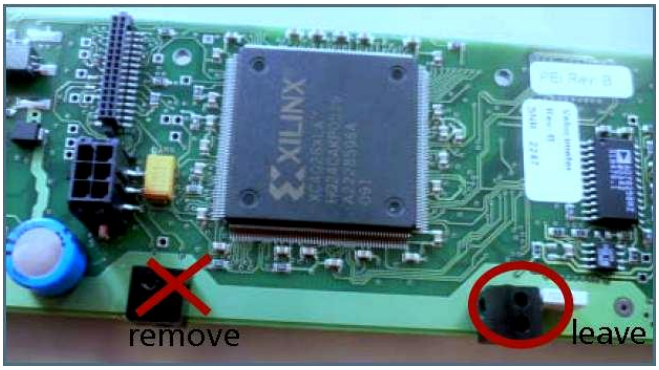
4. Mounting block

5. Threaded metal bolt

6. Long nylon screws

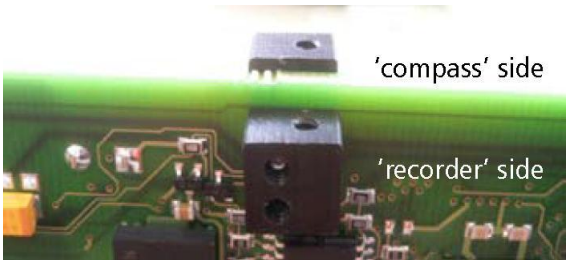
7. Memory board



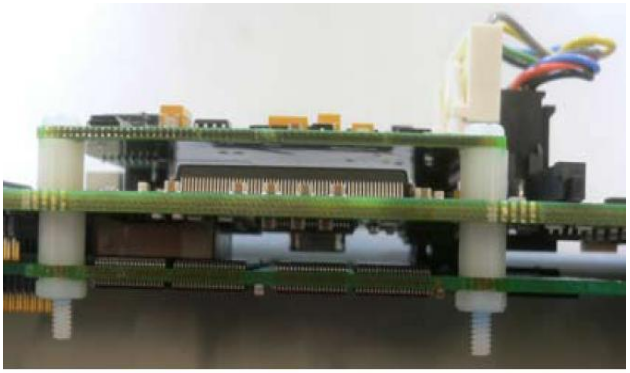


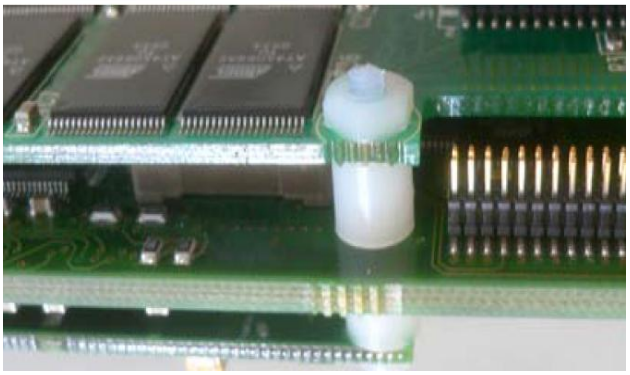
Remove the compass, remove all screws and blocks with the exception of the right mounting block as shown. Screw the metal bolt (5) through a mounting block (4) in the hole indicated.

Screw through the hole in the board and through another mounting block on the other side (both blocks on the same side of the main board). It is essential that the blocks are attached correctly. NOTE that the block on the 'compass' side of the card sticks out over the edge of the board, whereas the block on the 'recorder' side do not.



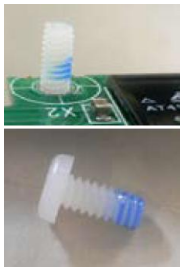
please note the positions of the various holes in the mounting blocks. It's essential that they are positioned correctly. Note that the twin holes are positioned 'away' from the center of the recorder.





Insert the two long nylon screws (6) through the holes in the compass, and through the nylon standoffs (1). Carefully insert throught the holes on the main board; opposite the mounting blocks. Attatch two more standoffs, and carefully position the recorder. Fit gently to the connector on the main board. Apply a little LocTite to the end

Attatch the recorder and compass to the mounting blocks with the short nylon screws. Apply a little LocTite to all plastic screws. Cut off excessive length on the long nylon screws.



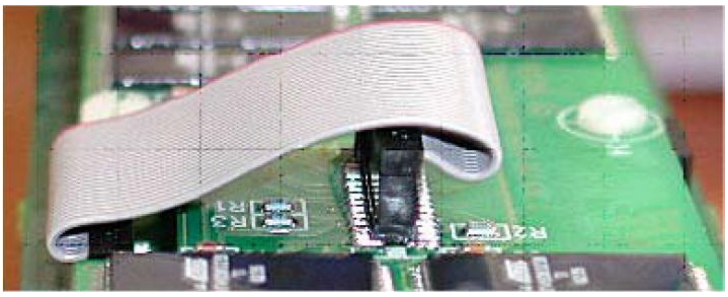
Connect the compass.

Reassemble system.

Erase recorder, and check that the system reads the right recorder size.

Installing a memory board with cable

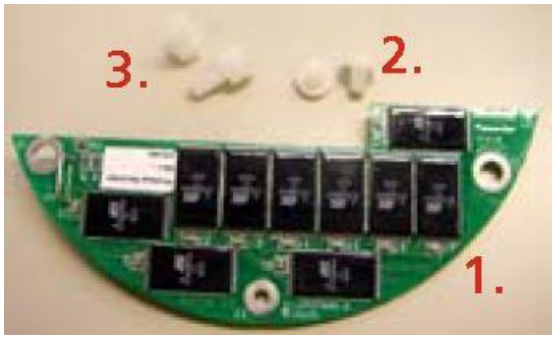
Some of the older systems will not fit the connector, and need a cable between the board and the recorder. It's essentially the same process as described on the reverse side. The recorder board looks a little different.



- Attach the cable to the main board ***before*** fixing the recorder to the main board.

- Attach and bend the cable as shown, to avoid cable getting caught while inserting the instrument into the housing.

Installing a memory board – AWAC before midlife



1. AWAC memory board
2. 2x nylon screws
3. 2x nylon stand-offs

Large screwdriver

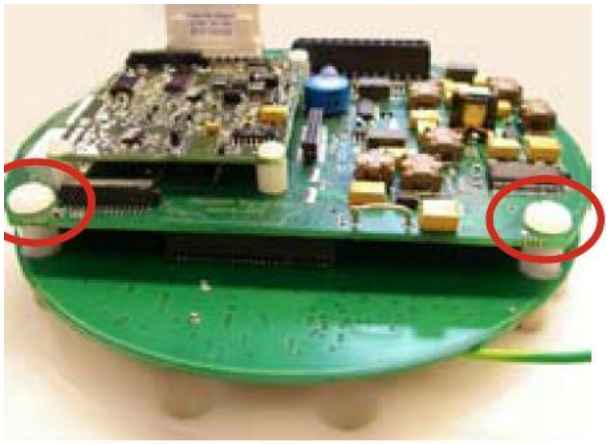
Adjustable wrench

LocTite

Unscrew and remove the bolts that holds the head to the system.

Gently lift the head part up and out, and place transducer down on the table. Take care not to damage or stretch the cables or the O-rings.

Unclip the cables: the ground cable at the joint, the main cable at the cicuit board.



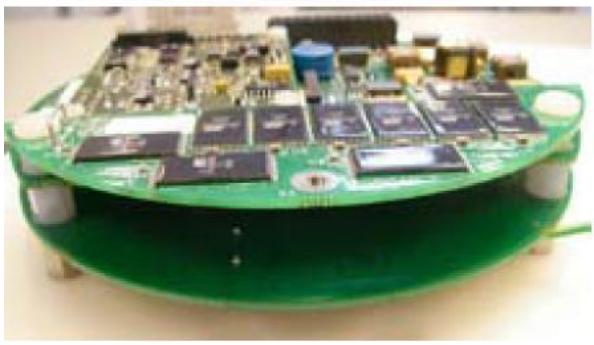
Unscrew and remove the two nylon screws shown in the photo.

Add a little LocTite to the two nylon stand-offs, and screw them in place.

Carefully align the connector on the recorder with the one on the circuit board and gently press down.

Apply a little LocTite to the two screws and fasten the recorder to the stand-offs.

Reattach the cables to the head.



Inspect the O-rings before reassembling the system, and take care not to damage the cables. If needed, add silicone grease to the O-rings.

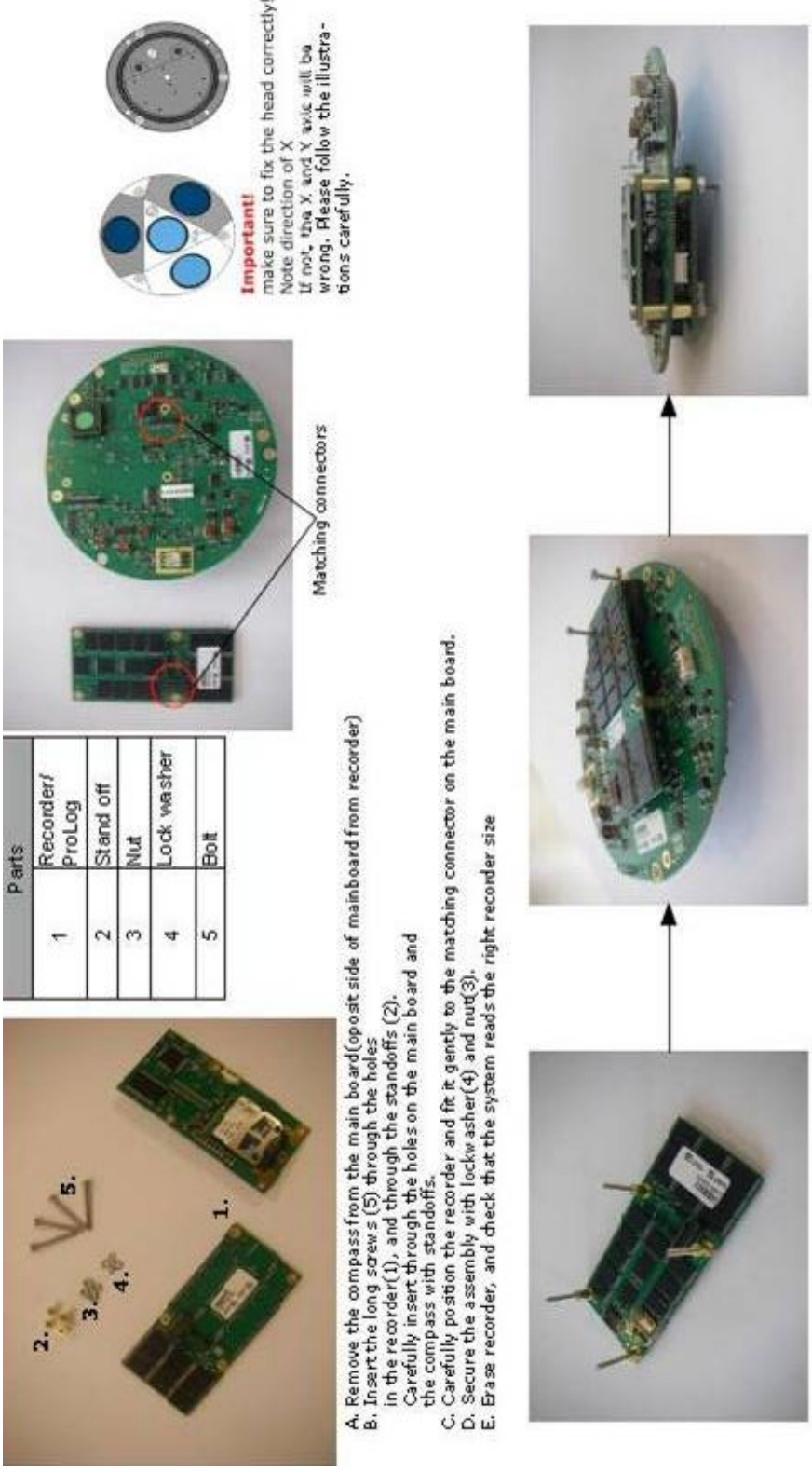
Important! When reassembling, make sure to fix the head correctly!

If not, the X and Y axis will be wrong.

Fasten and tighten bolts well.

Erase recorder, and check that the system reads the right recorder size.

Installing a memory board – AWAC midlife



4.4 CHANGING THE WIRING HARNESS

You will find the nessecary tools in the toolkit that came with the instrument. Use silicone grease and LocTite as described below, if accessible.

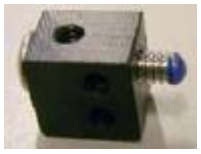
1. Unscrew the endbell, remove the battery.

2. Unscrew the head, and carefully pull the system out of the housing.

3. Unscrew the two screws that holds the harness in place.

4. Press the little tap on the connector, and pull the harness off.

5. Insert the longer screws as show, add a little LocTite (it is important that the holes in the mounting block are positioned correctly).



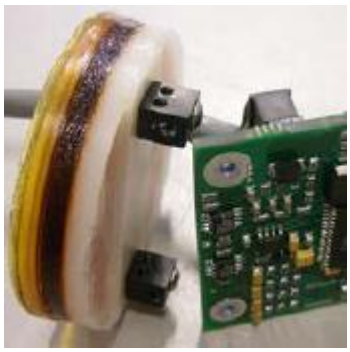
6. Attach the screws to the new harness and align as shown.

7. Attach the connector first.

8. Align the mounting blocks with the holes in the main board.

9. Add a little LocTite to the screws as above, and fasten.

10. Add a thin layer of silicone grease on the 'lip' of the harness.



11. Carefully insert the system into the housing.

12. Make sure that there are no dust or particles on the o-rings, and that they are whole.

13. Attach the head to the housing with the titanium bolts. Make sure the bolts have both a spring washer and a flat washer.

14. Insert and connect battery, attach endbell.

4.5 CHANGING THE OUTPUT POWER FOR AUXILIARY SENSORS

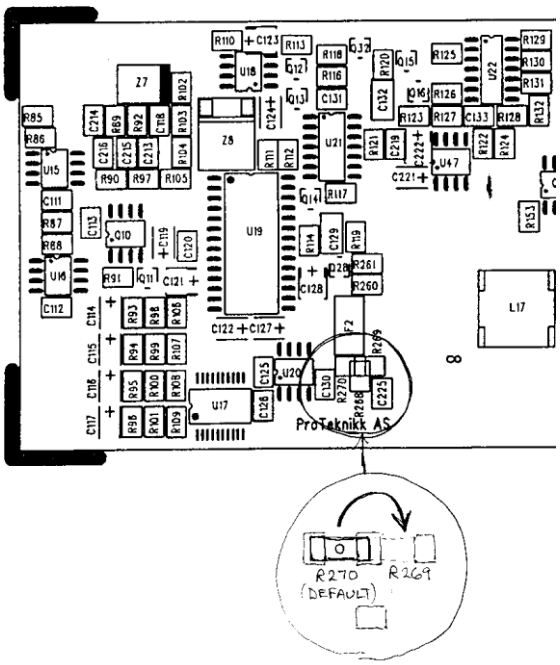
4.5.1 "OLD" ELECTRONICS

You can change the output voltage level that is supplied to external sensors. This is typically needed if an external analog sensor (e.g. OBS) operates in a specific voltage range and the raw battery power does not fall within this range.

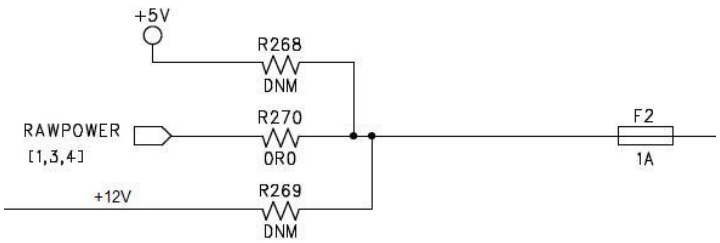
The default output voltage level is RAW (battery or external adapter). This can be changed to +5V or to +12V by changing the position of a 0-Ω resistor.

Voltage level	Resistor position	Max current
RAW	**R270 (default)**	**500 mA**
+5V	**R268**	**200 mA**
+12V	**R269**	**50 mA**

The three resistor positions share one pad so the modification should be straightforward.



Example of how you can change the output voltage level from



RAW to +12V

4.5.2 MIDLIFE ELECTRONICS

Midlife electronics change the power levels with a simple command in the terminal emulator

Voltage level	Command	Max current
RAW	OPWRBA	500 mA
+5V	OPWR12	250 mA
+12V	OPWR5V	100 mA

5. MECHANICAL ASPECTS

5.1 MECHANICAL TOLERANCES

Watertight sealing of the instrument housing is provided by double O-rings on the head and endbell sub-assemblies. The outer O-ring forms the primary seal, and the inner forms a secondary (or backup) seal.

When opening the instrument, great care should be taken to keep the sealing surfaces clean and protected from mechanical damage.

If the instrument has been subjected to environmental conditions outside the specified design limits, mechanical tolerances may be affected. The diameter of the primary O-ring seal should be 57.5 mm (minimum 57.25 mm). If the diameter is less than this, at any point along the circumference, the head or endbell should not be re-deployed, and instead returned to Nortek.

5.2 PLASTIC DEFORMATION

The Nortek instruments are intended for use in water. Other fluids may have an adverse effect on the plastic materials used.

For prolonged storage at elevated temperatures close to or at the specified limit, or when temperature control is uncertain, it is recommended that the screws securing the endcaps be loosened in order to minimize the risk of any deformation due to a temperature/stress condition over time.

Do not use the moulded head or endbell as a clamping surface, always clamp to the instrument housing.

5.3 RECOMMENDED TORQUE FOR SECURING SCREWS

When installing the endcaps, care should be taken when tightening down the screws. When the O-ring starts to be compressed, turn each screw a little at a time until the O-ring is fully compressed. Tightening one screw fully before continuing on to the next may cause improper O-ring seating and very high mechanical stress concentrated around the screw hole. This may cause leaks and/or damage to the head or endbell.

The screws need only be tightened sufficiently for the O-ring and spring washers to be fully compressed.

Over-torquing has no positive effect and may damage the threads and/or area around the screw holes on the head and endbell

5.4 O-RING MAINTENANCE

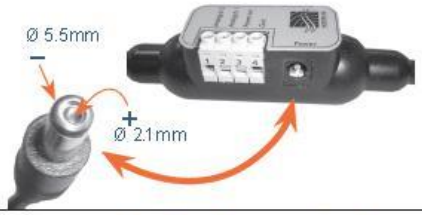
O-rings are the critical component that keeps water out of the housing and the instrument dry. Make a routing of O-ring inspection, maintenance and replacement.

- Check the o-rings and the o-ring grooves for grit, hair, lint, sand, or anything that could potentially breach the O-ring seal.
- After frequent deployments or if o-rings or groves appear dirty, remove o-rings and clean the groves. To remove o-rings, use finger pressure or the rounded edge of a plastic card to lift the O-ring out of the grove. **CAUTION: Never use a metal object to remove an O-ring. It may cause damage to the O-ring or the sealing surface.**
- To check o-rings for damage, place the O-ring between the middle and index finger and thumb. Then pull the O-ring through your fingers, feeling for any debris or wear.
- If o-rings are dirty, it is best to replace them. Washing dirty o-rings with soap and water is not recommended. Soap breaks down the lubricants and will compromise the integrity of the seal.
- Properly greased o-rings will help maintain sealing integrity and minimize O-ring degradation. Use enough grease to lubricate the O-ring thoroughly, but not so much that it will attract additional debris.
- Clean the groove with a lint free swab or the folded edge of a paper towel.

6. CABLES AND WIRES

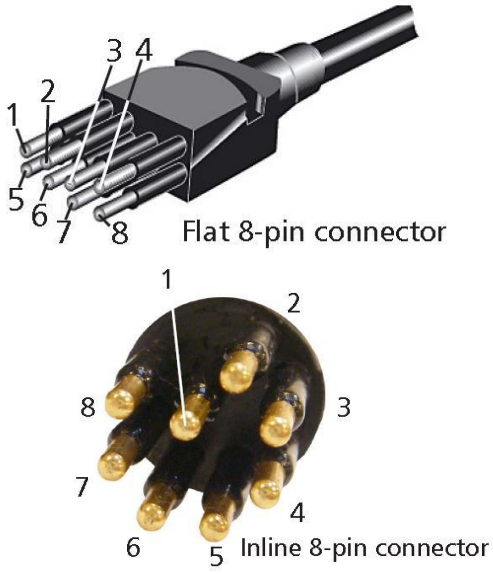
This chapter gives you the wiring for the most common cables. The wiring is the same if the cable is circular or square. In addition there is a table with which signals comes from where in 24 pin connector at the electronics board. This might be handy if there is need to change the wiring harness without time to receive it from Nortek.

Wiring of RS 232 cable with analogue input

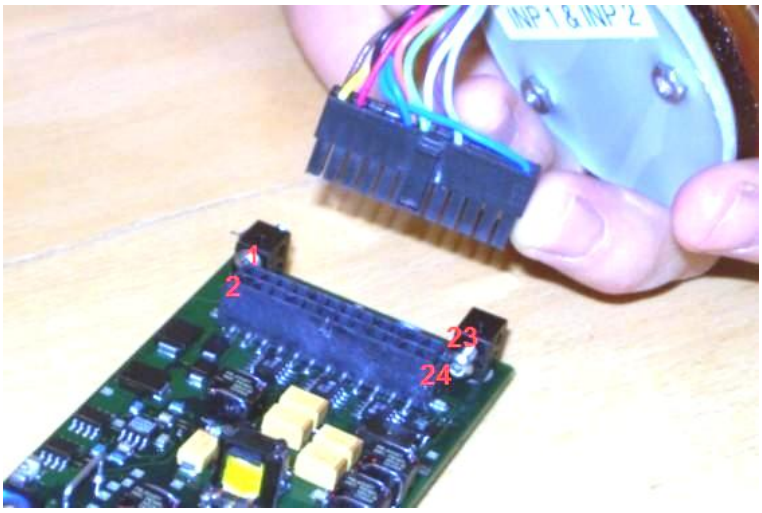
Underwater connector				Termination	
Pin No.	Wire colour	Purpose		Pins	Description
3	black	RS232 Tx	twisted pair	2	
4	white	RS232 Rx		3	
5	black	RS232 Gnd	twisted pair	5	
6	white/purple	Power output			
7	black	Analogue ch 2	twisted pair		
8	white/orange	Analogue ch 1			
1	black	Power Gnd	twisted pair		
2	white	Power +			
screen	bare	Gnd	ground	3 bare wires for Gnd, connected internally to power Gnd	

Wiring of 8-conductor cable for RS422 communication

Underwater connector				Termination	
Pin No.	Wire colour	Purpose		Pins	Description
3	black	RS422 Tx+	twisted pair	7	
4	white	RS422 Tx–		2	
7	black	RS422 Rx+	twisted pair	3	
8	white/purple	RS422 Rx–		8	
5	black	Synch. out	twisted pair		
6	white/purple	Synch in			
1	black	Power Gnd	twisted pair		
2	red	Power +			
screen	bare	Power Gnd	ground	3 bare wires for Gnd, connected internally to power Gnd	



Pin #	Function
1	Power Ground
2	+ External Power Supply
3	Power Ground
4	+ Battery Supply
5	X Analog Out
6	Y Analog Out
7	Z Analog Out
8	Auxilliary Analog Out
9	CTD Power Out
10	Signal Ground
11	RS-232 Tx
12	RS-232 Rx
13	CTD RS-232 Tx
14	CTD RS-232 Rx
15	Analog In 1
16	Analog In 2
17	RS-422 Tx+
18	RS-422 Tx-
19	RS-422 Rx-
20	RS-422 Rx+
21	Sync Out
22	Sync In
23	+3.3V LP
24	RS-422 3.3V Supply (grounded for RS-232) (shorted to pin 23 for RS-422)



APPENDIX A FINAL TEST CHECKLIST

Final test checklist

NORTEK AS
Vangkroken 2
N-1351 Rud
Norway
Tel: +47 6717 4500
fax: +47 6713 6770
inquiry@nortek-as.com
www.nortek.no

Order number

Head ID

Hardware ID

Frequency

System type
- ☐ Aquadopp
- ☐ Aquadopp profiler
- ☐ Vector
- ☐ AWAC
- ☐ Continental
- ☐ .....

Firmware version

Comments

Lable checked
☐ OK

Dock test
☐ OK

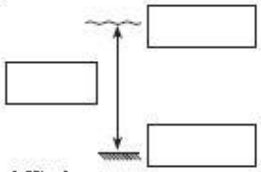
Tilt check
- ☐ Pitch up
- ☐ Roll up
- ☐ Status bit
- ☐ Pitch down
- ☐ Roll down

pitch & roll within ± 0.2°

Heading
- ☐ Up
- ☐ Down

tolerance: ± 0.2°

Pressure



tolerance: ± 0.5% of ____ m ☐ OK

Temperature
☐ OK

tolerance: ± 0.1°

Beam check

	Correct order	Noise floor	Amplitude in tank	Range	Velocity direction
Beam 1	☐ OK		>	☐ OK	☐ X ☐ E
Beam 2	☐ OK		>	☐ OK	☐ Y ☐ N
Beam 3	☐ OK		>	☐ OK	☐ Z ☐ U
Beam 4	☐ OK		>	☐ OK	

Head file
- ☐ Headfile checked
- ☐ Saved as read only

Harness test
☐ OK
Type:

Recorder erased
☐ OK
Rec. size: MB

External sensors

Power down
- ☐ OK
- ☐ Battery disconnected upon shipping

day | month | year
Date

Signature

HQM03-110 01